

**To:** Beeler, Cindy[Beeler.Cindy@epa.gov]  
**Cc:** Albright, David[Albright.David@epa.gov]  
**From:** Basinger, David  
**Sent:** Thur 6/30/2016 6:37:00 PM  
**Subject:** RE: PNAS: Salinity of deep groundwater in California: Water quantity, quality, and protection

Thanks for sharing, Cindy

Interesting in that there was at least some length of time where California protected USDWs to only 3,000 ppm TDS whereas federal regs required protection to 10,000 ppm TDS. I believe this discrepancy is in now being corrected, which could lead directly to an increase of the amount of deep groundwater being protected. I've cc'd David Albright, manager of our groundwater office, in case he wants to clarify/correct anything.

**From:** Beeler, Cindy  
**Sent:** Tuesday, June 28, 2016 9:51 AM  
**To:** Basinger, David <Basinger.David@epa.gov>  
**Subject:** PNAS: Salinity of deep groundwater in California: Water quantity, quality, and protection

Dave –

Recent research paper making the case for protection of deep groundwater aquifers in CA, in some of which O&G activities occurring.

I thought I remembered you used to be in UIC – please pass on to your folks who may be interested.

<http://www.pnas.org/content/early/2016/06/21/1600400113>

**Significance**

Groundwater withdrawals are increasing across the United States, particularly in California, which faces a growing population and prolonged drought. Deep groundwater aquifers provide an alternative source of fresh and saline water that can be useable with desalination and/or treatment. In the Central Valley alone, fresh groundwater volumes can be increased almost threefold, and useable groundwater volumes can be increased fourfold if we extend depths to 3,000 m. However, some of these deep groundwater resources are vulnerable to contamination from oil/gas and other human activities. Our findings provide the first estimates, to our knowledge, of underground sources of drinking water depths and volumes in California and show the need to better characterize and protect deep groundwater aquifers.

## **Abstract**

Deep groundwater aquifers are poorly characterized but could yield important sources of water in California and elsewhere. Deep aquifers have been developed for oil and gas extraction, and this activity has created both valuable data and risks to groundwater quality. Assessing groundwater quantity and quality requires baseline data and a monitoring framework for evaluating impacts. We analyze 938 chemical, geological, and depth data points from 360 oil/gas fields across eight counties in California and depth data from 34,392 oil and gas wells. By expanding previous groundwater volume estimates from depths of 305 m to 3,000 m in California's Central Valley, an important agricultural region with growing groundwater demands, fresh [

### **Cindy Beeler**

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